

A certain songbird exists in two types, Coastal and Inland, separated by a desert. The Inland form differs from the Coastal form by several chromosome rearrangements. If we bring birds from the two populations together, they are willing and able to mate, and have healthy young (“F1 generation”), but the young are completely sterile. They cannot assort their chromosomes correctly in meiosis to produce viable eggs or sperm. No grandchildren (“F2 generation”) are produced.

Farmers irrigate the desert and birds can now cross it. If they mate with the wrong type, they will conduct courtship, build a nest, lay eggs, incubate the eggs and feed the young, but it’s all useless as the offspring are sterile. During each step of this process the birds are at increased risk from predators due to distraction.

These birds live for several years and can produce a clutch of eggs each year.

1. Here are some *new genetic traits which could arise* in these birds. Number them in order of their usefulness in improving the fitness of the songbirds, with 1 being best and 5 being worst:
 - Hybrid young (F1) die shortly after hatching
 - Purebred Coastal birds breed in a different season than Inland birds, and will not even try to court in the wrong season
 - Hybrid eggs (F1) abort before they are laid
 - Hybrid birds (F1) have unattractive plumage and cannot attract mates
 - Purebred (Coastal or Inland) males will attempt to court foreign females, bringing them gifts and singing to them, but the females always reject them
2. Briefly explain the reasoning you used in (1).
3. Are there any traits on the list which could not be selected for at all? If so, which ones, and why? If all could be selected for, briefly explain how.
4. Some climatologists argue that the desert has been continuously present for thousands of years; others argue that during wetter decades it is fertile enough for songbirds to cross, and such wet decades occur frequently. Which theory do our songbirds support? Why?
5. We find several other species of songbirds closely related to the Coastal and Inland birds. All of them have the same chromosome arrangement as Coastal, whereas Inland has a unique chromosome arrangement. What does this suggest about the history of the Inland population?
6. Given all available evidence, including the chromosome data, what type or types of speciation events likely produced the Inland songbird species—parapatric, peripatric, allopatric, or sympatric? Why? (More than one answer may be reasonable.)